

Data Necessary to Compute Radiological Risks from Flyash Associated with Yard 520

The data necessary for computing radiological risks from flyash associated with Yard 520 is incomplete. Only Uranium-238 and Uranium-235 were measured by ICPMS. There is no data at all for the Thorium (Th-232) Decay Series.

[illegible]

Available Data

Data for peak concentrations of uranium-238 and uranium-235 were measured by ICPMS.

| | |
|-------------|----------------------------------|
| Uranium-238 | 14.5 picocuries per gram (pCi/g) |
| Uranium-235 | 0.044 pCi/g |

This data is of uncertain quality since the natural ratio for uranium-235 to uranium-238 (by activity) is 0.046. The ratio for this data is 0.030.

[illegible]

Background Determinations

To calculate excess risk, background concentrations must be subtracted from the above gross concentrations. Background concentrations can be determined somewhat.

For the Uranium Decay Series, the average measured background concentrations (measured by gamma spectrometry, not by ICPMS) are

| | |
|--------|-------------|
| U-238 | 0.317 pCi/g |
| U-234 | 0.277 pCi/g |
| Ra-226 | 0.280 pCi/g |

For natural uranium these concentrations should all be equal. Thus, this data is of uncertain quality. Using the available data, the mean is

| | | |
|----------------------------|-------------|----------------|
| Mean, Uranium Decay Series | 0.291 pCi/g | |
| Net concentration | 14.2 pCi/g | (14.5 – 0.291) |

These background and net concentrations will have to be used for each radionuclide in the decay series.

[illegible]

For the Thorium Decay Series, the only measured background values are for Radium-228. These are by gamma spectrometry, not ICPMS. The average background concentration is

| | |
|----------------------|------------------------|
| Thorium Decay Series | 0.339 pCi/g |
| Net concentration | to be determined below |

[illegible]

| | | |
|----------------------------------|--------------|-----------------|
| Actinium Decay Series background | 0.052 pCi/g | |
| Net concentration | -0.008 pCi/g | (0.044 – 0.052) |

These background and net concentrations will have to be used for each radionuclide in the decay series. Since the net concentration is less than zero, 0 pCi/g will be used for calculations.

[illegible]

Since it is reasonable to assume that the two decay series which uranium-238 and uranium-235 initiate are in equilibrium, then all the radionuclides in the Uranium Decay Series (U-238) should be assigned a net activity concentration of 14.2 pCi/g. For example, this means U-234 and radium-226 (Ra-226) should be assigned an activity of 14.2 pCi/g.

[illegible][illegible]

First, convert the U-238 activity concentration to ppm. Conversions supplied through the Health Physics Society (<http://www.hps.org/publicinformation/ate/q6747.html>) can be used.

2.97 ppm, U-238, is equivalent to 1 pCi/g, U-238
9.08 ppm, Th-232, is equivalent to 1 pCi/g, Th-232

Thus, 14.2 pCi/g, U-238, is equivalent to 42.2 ppm (14.2 times 2.97).

And, 42.2 ppm, U-238, corresponds to 105.5 ppm, Th-232 (42.2 times 2.5) or 11.6 pCi/g (105.5 divided by 9.08), Th-232.

Finally, all the radionuclides in the Thorium Decay Series, including radium-228 (Ra-228) should be assigned an activity of 11.6 pCi/g.

[illegible]

In summary, computations for the radiological risk from Yard 520 flyash should use the net activity concentrations:

| | | |
|-------------------------------|------|-------|
| Uranium Decay Series (U-238) | 14.2 | pCi/g |
| Thorium Decay Series (Th-232) | 11.6 | pCi/g |
| Actinium Decay Series (U-235) | 0.0 | pCi/g |

Once soil concentrations have been obtained, the risk from soil exposure should be computed. It should be assumed that all the radionuclides in each of the three natural decay series contribute to risk. The U.S. Environmental Protection Agency (EPA) has established radiological human health risk assessment guidance, radiological dose conversion factors, and radiological dose equivalent to risk factors. The most up-to-date guidance and coefficients should be used.